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NOTES ON THE MOUND FLORA OF ATCHISON COUNTY,
MISSOURI.

BY B. F. BUSH.

Having concluded that Atchison County, Missouri, on account of its extreme northwestern position, would prove a fertile field for botanizing, I consulted with Dr. Trelease upon the advisability of making a thorough investigation of that part of the State, and he very generously placed me in shape to begin the work.

About the middle of August, 1893, I made my first trip to that place, and was struck at once by the remarkable line of loess mounds running parallel with the Missouri River in Missouri, from Hamburg in Iowa, down to a few miles south of Saint Joseph, Missouri, where the last bald-headed mound appears.

These singular mounds are evidently the result of the glacial period, when great masses of ice were borne toward the equator, until they were stranded along the low rocky bluffs of the Missouri River, and as they melted, the mud and debris settled to the bottom and thus formed these mounds.

These mounds are very irregular and jagged, running in straight lines, or else in fantastic loops and curves, often abruptly terminating in a very high perpendicular wall, which is almost unaffected by the action of the weather: or commonly descending gently to the level bottom which surrounds all sides except on the east.

At a distance these mounds appear to be terraced, as if furrowed by the plow, but on a closer examination it is revealed that the apparent terraces are trails made by cattle, which are nearly always to be found grazing on them. These trails are about four feet apart and either follow a horizontal line around the mounds, or else gradually incline

upward to the top of them, and a well defined trail leads from the top of one mound down the side and along the low backbone to the side and top of the next mound, and so on to all the mounds.

I have found these trails of considerable advantage in climbing over and around the mounds, and in going from one mound to another, and I have never seen one isolated mound in Atchison County.

The south and west sides are those which are steep and precipitous, but sometimes they descend gradually to the bottom lands at their bases. The north and east sides are usually descending and are covered with a short thick growth of trees and shrubs near their bases, but which does not rise as high up on the north side as on the east, as it sometimes reaches quite to the top on the latter.

The texture of the soil is a thin, slightly sandy loess, very compact and hard, so much so, that names carved in the face of the steep sides endure for many years. The fertility of the soil is very low and supports only such plants as will thrive in similar conditions, being covered with a short growth of grasses, such as *Bouteloua hirsuta*, *B. oligostachya* and *Sporobolus airoides*.

There is a belt of heavy timber back of the mounds, which averages about one mile in width, and which is somewhat lower than the mounds, and back of this is a high rolling prairie, which is considerably lower than the mounds. Between the mounds and the Missouri River is an extremely fertile gombo bottom-prairie which is sometimes several miles in width, and often not a mile wide, which has a flora very similar to the general Missouri River bottom flora, except that a few of the peculiar species of the mounds are here present and should not be considered as characteristic of it.

Where the south and west sides are steep and precipitous, there are to be found in abundance such plants as *Yucca glauca*, *Gaura coccinea*, *Psoralea argophylla*, *Meriola serulata* and *Sporobolus airoides*; where they descend gradu-

ally to the bottom below, such plants as *Pentstemon grandiflorus*, *Astragalus lotiflorus* and *Parosela enneandra* are found. On the north there are usually pockets running up the sides of the mounds which are generally covered with dwarfed trees and shrubs, principally *Corylus Americana*, *Prunus Virginiana*, *Ostrya Virginica*, *Rhus glabra*, and *Salix humilis*.

The tops of these mounds are the most peculiar feature of the whole country, for they present from a distance a very much denuded appearance, as if entirely devoid of vegetation. They vary considerably in height, some not being one-third as high as the most elevated, and one of the chain is said to be the highest point in the State, and no doubt to this great elevation is due their peculiar flora.

The characteristic species of these mounds are *Pentstemon grandiflorus*, *Spiesia Lamberti*, *Castilleja sessiliflora*, *Psoralea argophylla*, *Gaura coccinea*, *Glycyrrhiza lepidota*, *Yucca glauca*, *Meriola serrulata*, *Sporobolus airoides*, *Anemone cylindrica*, *Lacinaria punctata*, *Bouteloua hirsuta*, *B. oligostachya*, *Astragalus lotiflorus*, *Gerardia aspera*, *Parosela enneandra*, *Lithospermum angustifolium*, *Lygodesmia juncea*, *Lactuca pulchella*, *Onosmodium molle*, and *Houstonia angustifolia*, these being the predominant plants, and not occurring in abundance elsewhere in the State.

The list here appended is based on specimens now in the Herbarium of the Missouri Botanical Garden which were also included in the sets distributed in 1893.

ANEMONE CYLINDRICA A. Gray.

Common on the tops of the mounds in bare ground: commonly with several peduncles involuclate in the middle. (Watson No. 3.)

ANEMONE VIRGINIANA L.

Common along the bases of the mounds, and in the hazel thickets. *A. Canadensis* L. (Watson No. 4), was abundant in the bottom just below. (Watson No. 5.)

DELPHINIUM CAROLINIANUM Walt.

Common on the tops of all the mounds. The pistils are commonly from three to seven, as I have noticed in the plants of Jackson County, Missouri. (Watson No. 8.)

ACTAEA ALBA (L.) Mill.

Rarely seen on the wooded eastern slopes of the mounds. (Watson No. 9.)

CLEOME SERRULATA Pursh.

Abundant on the lower part of the mounds. Has a very fetid odor, on account of which it is called Stinking Clover by the country people. (Watson No. 16.)

VIOLA PEDATIFIDA Don.

Common all over the bare parts of the mounds. *V. obliqua* Hill (Watson No. 21), was common in the woods on the east of the mounds. (Watson No. 19.)

VIOLA PALMATA L.

Very common along the bases of the mounds. (Watson No. 20.)

HYPERICUM ASCYRON L.

On the northern sides of several of the mounds. At one mound, I estimated that there were between ten and fifteen thousand plants in one patch, about four miles northeast of Watson. (Watson No. 37.)

LINUM SULCATUM Ridd.

On the bare tops and sides of the mounds, usually with *Gerardia aspera* Dougl., which it not a little resembles. (Watson No. 42.)

CEANOTHUS OVATUS Desf.

Very common on the sides of the mounds, and appearing quite distinct from the next in appearance and mode of growth. (Watson No. 120.)

CEANOTHUS OVATUS PUBESCENS T. & G.

Also quite common in same situations as the foregoing.
(Watson No. 121.)

POLYGALA VERTICILLATA L.

Quite common on the bare parts of the mounds. (Watson No. 184.)

TRIFOLIUM REFLEXUM L.

Common over most parts of the mounds in bare ground.
(Watson No. 187.)

PSORALEA ARGOPHYLLA Pursh.

Abundant on the steep precipitous faces of the mounds.
One of the most striking species of the whole mound flora. (Watson No. 211.)

AMORPHA CANESCENS Pursh.

Common on the sides of the mounds. Specimens nearly two meters in height were observed at several places. (Watson No. 217.)

PAROSELA ENNEANDRA (Nutt.) Britton.

Abundant on all the mounds, but mostly on the steep sides to the south and west. (Watson No. 220.)

PAROSELA DALEA (L.) Britton.

Common on the lower part of the mounds, and along the backbones, and still more common on the bottom prairie below. (Watson No. 219.)

KUHNISTERA PURPUREA (Vent.) MacM.

Abundant along the backbones connecting the mounds. The heads are all very short-oblong or oval. (Watson No. 222.)

KUHNISTERA CANDIDA (Willd.) Kuntze.

With, and as abundant as the last, and heads also much reduced. (Watson No. 221.)

ASTRAGALUS LOTIFLORUS Hook.

(*A. elatiocarpus* Sheld. Bull. Minn. Geol. and Nat. Hist. Surv. n. 9: 20. 1894, at least as to forma *brachypus*. *A. lotiflorus* formae *brachypus* and *pedunculatus* of Gray.)

Abundant on all the gentle slopes and along the backbones of the mounds. When I first collected this species in August, 1893, it was in fruit, with very short or no peduncles, which led Dr. Trelease and myself to place it with the forma *brachypus* of Gray.

On April 20th, 1894, I collected it again, but this time it was in flower and with very long peduncles. This led me to write Dr. Trelease the statement that the earlier flowers were very long peduncled and infertile, while later on it produced fertile flowers on very short peduncles; for some last year's fruits were still on some plants and no sign of long peduncled fruit had been observed the year before. On June 1st, I again collected the plant and this time it had fruit on both long and short peduncles. On July 11th, the long peduncles had mostly dropped off the plants, leaving only the short peduncled fruit. This clearly shows that the species has both long and short-peduncled fruit, and that the formae *brachypus* and *pedunculatus* of Gray occur on the same plants. I strongly suspect that the *Astragalus elatiocarpus* of Sheldon is an entirely different species. (Watson Nos. 198, 199, 200 and 203.)

SPIESIA LAMBERTI (Pursh) Kuntze.

Common on the steep precipitous sides of the highest of the mounds. The roots are exceedingly long and tough, and often are seen hanging over the bluffs from which the earth has crumbled away and left them. (Watson No. 204.)

GLYCYRRHIZA LEPIDOTA Pursh.

Common at the bases of the mounds in bare and somewhat gravelly ground. (Watson No. 205.)

PHASEOLUS PAUCIFLORUS Benth.

Common along the lower part of the mounds, and along the backbones. *P. angulosa* Missouriensis (Wats.), Britt. (Watson No. 213), was tolerably common in marshy places on the bottom-prairie near the mounds. (Watson No. 212.)

ACUAN ILLINOENSIS (Michx.) Kuntze.

Very common in the bare gravelly ground at the base of the mounds. (Watson No. 214.)

PRUNUS VIRGINIANA L.

Abundant in the pockets on the north sides of the mounds, and is said by the country people to rarely fruit. (Watson No. 243.)

ROSA ARKANSANA Porter.

Abundant on the lower part of the mounds and along the backbones. The receptacles are unusually large, ranging from 12 mm. to 18 mm. in thickness, and the stems of the season are often 25 mm. thick and exceedingly prickly. (Watson No. 246.)

AMELANCHIER CANADENSIS (L.) Medic.

Common on the east sides of the mounds, and in the pockets on the north, often becoming quite arborescent. (Watson No. 313.)

MERIOLA SERRULATA (Nutt.) Walp.

Abundant on the tops and sides of all the mounds. The flowers are from 12 to 15 mm. wide. (Watson No. 330.)

GAURA PARVIFLORA Dougl.

Common near the base of the mounds, and along the backbones. (Watson No. 334.)

GAURA COCCINEA Pursh.

Abundant on the steep faces of most of the mounds.
(Watson No. 333.)

SYMPHORICARPUS OCCIDENTALIS Hook.

Abundant at the base of the mounds, and in the pockets on the north sides. *S. Symphoricarpus* (L.) MacM. (Watson No. 378), which flowers a month or more later, is abundant in the belt of timber to the back of the mounds.
(Watson No. 379.)

HOUSTONIA ANGUSTIFOLIA Michx.

Common on the tops and down the sides of the mounds. This is probably the only locality north of the Missouri River where this species is found in the State. (Watson No. 384.)

KUHNTIA EUPATORIOIDES L.

Common near the base of the mounds in bare ground.
(Watson No. 389.)

LACINARIA PUNCTATA (Hook.) Kuntze.

Common on the steep faces on the south and west sides of the mounds. The other known Missouri stations for this species are: on a high rocky ridge on the prairie west of Lee's Summit in Jackson County, and on a bald knob in Wright County. *L. pycnostachya* (Michx.) Kuntze (Watson No. 388), is common on the bottom prairie close by the mounds. (Watson No. 387.)

SOLIDAGO SPECIOSA Nutt.

Common on most of the mounds in open ground, but being a much reduced form. (Watson No. 397.)

SOLIDAGO RUPESTRIS Raf.

Abundant on the tops of the mounds. The plants are very much reduced, being only about 3 dm. in height.
(Watson No. 398.)

SOLIDAGO NEMORALIS Ait.

Abundant all over the mounds in bare ground, and also very much reduced in size like the two last species. (Watson No. 399.)

SOLIDAGO RIGIDA L.

Common on the bare open places on most of the mounds. *S. Canadensis* L. (Watson No. 395), and *S. ulmifolia* Muhl. (Watson No. 396), were common in the belt of timber at the back of the mounds. (Watson No. 400.)

ASTER OBLONGIFOLIUS Nutt.

Common in bare ground mostly all over the mounds. (Watson No. 403.)

ASTER SERICEUS Vent.

Abundant on the tops and over the bare parts of the mounds generally. (Watson No. 404.)

ASTER AZUREUS Lindl.

Common to all the bare parts of the mounds. (Watson No. 405.)

ASTER DRUMMONDII Lindl.

Common on the sides of the mounds in the hazel thickets. (Watson No. 406.)

ASTER LAEVIS L.

Common on the open parts of the mounds. (Watson No. 402.)

ASTER ERICOIDES L.

Common on the lower part of the mounds. (Watson No. 407.)

ASTER AMETHYSTINUS Nutt.

Abundant on nearly all the mounds in bare ground. Specimens were collected that had simple unbranched

stems one meter in height. Very much resembles *A. multiflorus* Ait., and indeed it may yet prove to be an extreme form of that species, but after a long comparison with authentic specimens, and a critical examination of all the specimens collected, Mr. J. G. Smith and I decided that it must be a form of *A. amethystinus*. One other Aster, *A. paniculatus* Lam. (Watson No. 409), was collected on the bottom-prairie near the mounds. (Watson No. 401.)

ANTENNARIA PLANTAGINIFOLIA (L.) Rich.

Common on the bare parts of the mounds. (Watson No. 414.)

SILPHIUM INTEGRIFOLIUM Michx.

Common down the sides of all the mounds. *S. laciniatum* L. (Watson No. 416), and *S. perfoliatum* L. (Watson No. 417), were abundant on the bottom-prairie below the mounds. (Watson No. 415.)

HELIOPSIS SCABRA Dunal.

Common along the backbones of the mounds. (Watson No. 418.)

HELIANTHUS MAXIMILIANI Schrad.

Common down the sides and along the backbones of most of the mounds. *H. grosse-serratus* Martens (Watson No. 420), which it somewhat resembles, is abundant on the bottom-prairie below. Since Maximilian collected the species in Missouri in 1815, it has been found in Wright County, 1884 (Bush), and in Jackson County at Sheffield, 1892 (Bush No. 413). (Watson No. 419.)

ARTEMISIA GNAPHALODES Nutt.

Abundant around the bases of the mounds, and along the backbones. (Watson No. 421.)

CACALIA TUBEROSA Nutt.

Common near the base of the mounds. (Watson No. 422.)

CARDUUS UNDULATUS Nutt.

On several mounds about half way up their sides. *C. altissimus* L. (Watson No. 433), and *C. lanceolatus* L. (Watson No. 434), were common on the bottom prairie below. (Watson No. 429.)

LYGODESMIA JUNCEA (Pursh) Don.

Abundant all over the mounds, wherever the ground is bare and free of shrubs. (Watson No. 428.)

LACTUCA PULCHELLA (Pursh) D. C.

Common near the bases of nearly all the mounds. Flowers a month earlier than any of our other *Lactucas*. (Watson No. 427.)

LACTUCA LUDOVICIANA (Nutt.) D. C.

Common with the last species. Several other species, as *L. scariola* L. (Watson No. 424), *L. Canadensis* L. (Watson No. 425), and *L. sagittaeifolia* Ell. (Watson No. 423), were common near the mounds on the bottom-prairie. (Watson No. 426.)

ASCLEPIAS VERTICILLATA L.

Abundant on all the bare parts of the mounds. *A. Sulivantii* Engelm. (Watson No. 436), and *A. Syriaca* L. (Watson No. 437), were common on the bottom-prairie near the mounds. (Watson No. 435.)

ACERATES VIRIDIFLORA IVESII Britton.

Common on all the mounds in bare ground. (Watson No. 438.)

ACERATES VIRIDIFLORA LINEARIS A. Gray.

Not uncommon with the last. The specific form was not observed in the county. (Watson No. 439.)

LAPPULA LAPPULA (L.) Karst.

Common on nearly all the mounds, but most likely intro-

duced by the cattle which graze over the mounds. (Watson No. 472.)

LITHOSPERMUM CANESCENS (Michx.) Lehm.

Common on the open parts of the mounds. (Watson No. 474.)

LITHOSPERMUM ANGUSTIFOLIUM Michx.

Common on the tops of all the mounds. (Watson No. 473.)

ONOSMODIUM MOLLE Michx.

Common on the sides and along the backbones of the mounds. (Watson No. 475.)

PENTSTEMON GRANDIFLORUS Nutt.

Very common on the sides of the taller mounds, but not observed on the lower ones. (Watson No. 476.)

GERARDIA ASPERA Dougl.

Common on the tops and steep sides of the larger mounds. (Watson No. 479.)

CASTILLEJA SESSILIFLORA Pursh.

Abundant on the sides of nearly all the mounds. (Watson No. 481.)

TEUCRIUM OCCIDENTALE A. Gray.

Common down the sides of all the mounds, and spreading out into the bottom-prairie below, where it becomes abundant. Extends down the Missouri River to Holt County (Corning No. 482), where it is equally abundant, and to Jackson County (Courtney No. 485), where it is uncommon, and it has even been picked up in East Saint Louis by Eggert, but this last may have been introduced by means of hay with which it grew when cut. (Watson No. 483.)

SCUTELLARIA PARVULA Michx.

Common on the sides of most of the mounds. (Watson No. 484.)

EUPHORBIA GLYPTOSPERMA Engelm.

Abundant on the tops of all the taller mounds. (Watson No. 495.)

EUPHORBIA MARGINATA Pursh.

Abundant along the lower part of all the mounds. Called Snow-on-the-Mountain by the country people. *E. serpens* H. B. K. (Watson No. 497) was abundant on the bottom-prairie below. (Watson No. 496.)

QUERCUS MACROCARPA OLIVAEFORMIS (Michx. f.) A. Gray.

Common in the pockets on the north sides, and in thickets at the bases of the mounds. The growth of the year and the leaves are densely woolly-tomentose, and the trees are from 3 m. to 6 m. in height. (Watson No. 633.)

SALIX HUMILIS Marsh.

Abundant in the pockets on the north sides of all the mounds. (Watson No. 658.)

SISYRINCHIUM BERMUDIANUM L.

Common on the tops of nearly all the mounds. This is what has been called *S. angustifolium*, and which appears to me to be very distinct from *S. Bermudianum*, but I bow to the decision of the makers of the new Check List. (Watson No. 671.)

YUCCA GLAUCA Nutt.

Common to all the large mounds, on the steep precipitous sides on the south and west. When observed on June 1st, 1894, it was in full flower, and the Pronuba moth was present in great numbers, and on July 11th, I noticed that there was an abundance of mature fruits, many of which showed the insect punctures plainly. It is called Soap-weed by the

country people, who dig the long saponaceous roots for the purpose of making soap. (Watson No. 672.)

ANDROPOGON SCOPARIUS Michx.

Common along the bases of the mounds. (Watson No. 773.)

ANDROPOGON PROVINCIALIS Lam.

Common with the last species. (Watson No. 774.)

SPOROBOLUS AIROIDES Torr.

Abundant mostly all over the mounds, especially on the steep sides of them. (Watson No. 783.)

BOUTELOUA OLIGOSTACHYA (Nutt.) Torr.

Common on the tops of all the taller mounds. (Watson No. 798.)

BOUTELOUA CURTIPENDULA (Michx.) Torr.

Common on all the mounds in bare ground. (Watson No. 800.)

BOUTELOUA HIRSUTA Lag.

Abundant all over the mounds, and constitutes the principal forage for grazing. (Watson No. 799.)